

534 Rec'd 22 AUG 2000

What Is Claimed Is:

~~New Claims~~

~~1. An interferometric measuring device (1) for detecting the~~
 shape or distance in particular of rough surfaces, having at
 least one spatially coherent beam gun unit (3, 3'), whose beam
 is divided into a reference measuring beam guided through and
 reflected in a measuring reference arm (3.2) and a measuring
 beam guided through a measuring arm (3.1) and reflected on the
 rough surface, also having a device (9) for modulating the
 light phase or for shifting the light frequency corresponding
 to the heterodyne frequency of a first partial beam (16) with
 respect to the light phase or the light frequency of a second
 partial beam (17), also having a superimposing unit for
 superimposing the reflected measuring beam on the reflected
 measuring reference beam, also having a beam splitting and
 receiving unit (13) for splitting the superimposed beam into
 at least two beams having different wavelengths and converting
 the beam into electrical signals, and also having an analyzer
 (14), in which the shape or distance of the rough surface can
 be determined on the basis of a phase difference of the
 electrical signals,
 characterized in that

the beam emitted by the beam gun unit (3, 3') is broad-band
 and has a short time coherence;
 the beam gun unit (3, 3'), a beam splitter for forming the
 first and second partial beams (16, 17), and the device (9)
 for phase modulation or frequency shift are arranged in a unit
 (2) remote from the measuring probe (3), designed as a
 modulation interferometer, and
 a time delay element (10) is arranged in the unit (2) in the
 beam path of a partial beam, this delay element producing a
 difference of the optical wavelengths of the two partial beams
 (16, 17), which is greater than the coherence length of the
 beam emitted by the beam gun unit (3, 3').

~~2. The measuring device according to Claim 1, characterized in~~

1. The beam gun unit (1, 8') is a light source emitting a short time coherent and broad-band beam.

3. The measuring device according to Claim 1 or 2, characterized in that the unit (2) and the measuring probe (3) are coupled to one another via an optical fiber arrangement (6).

4. The measuring device according to one of the foregoing claims, characterized in that the unit (2) has a first beam splitter (13) for forming the first and second partial beams (16, 17) and a second beam splitter which receives the first and second partial beams (16, 17) and at which the two partial beams (16, 17) are superimposed on one another and which forwards the beam sent to the measuring probe (3) (Mach-Zehnder interferometer).

5. The measuring device according to one of the foregoing claims, characterized in that the beam gun unit (3, 8') has a short time coherent, broad-band and spatially coherent additional light source (3') which can be operated for light amplification or as a backup light source.

6. The measuring device according to one of the foregoing claims, characterized in that an additional device (9') for frequency shifting is arranged in the beam path of one of the two partial beams (16, 17) for frequency shifting the first partial beam (16) with respect to the second partial beam (17), and the device (9) and the additional device (9') for frequency shifting are acoustical-optical modulators.

7. The measuring device according to one of the foregoing

Claims,

characterized in that

the beam splitting and receiving unit (13) is a spectral device for splitting the light into a plurality of wavelengths and a downstream photodetector matrix for selectively receiving these wavelengths;

the beam splitting and receiving unit (13) is also mounted in the unit (2);

the beam splitting and receiving unit (13) is coupled to the measuring probe (3) via the optical fiber arrangement (6), and the phase differences of signals from the individual detectors of the photodetector matrix are used for determining the shape or the distance of the measured surface.

8. The measuring device according to one of the foregoing claims,

characterized in that

the measuring probe (3) having the measuring arm (3.1), the measuring reference arm (3.2), and a beam splitter of the measuring probe (3) is designed as a Michelson or Mirau interferometer,

and an optical path difference produced in the measuring arm (3.1) and in the measuring reference arm (3.2) compensates for the optical path difference produced by the time delay element (10).

9. The measuring device according to one of the foregoing claims,

characterized in that

an additional beam path is formed starting from the second beam splitter (12), leading to a reference probe (5) having a reference probe-reference arm (5.2) and a reference probe-measuring arm (5.1);

an additional beam splitting and receiving unit (13') is provided in the unit (2), and

the unit (2) is coupled to the reference probe (5) via an additional optical fiber arrangement (7).

10. The use of the measuring device according to one of the foregoing claims, ^A characterized in that the measuring device is used for measuring the internal geometry of boreholes.